

REMARKS/ARGUMENTS

1. Concerning the Amendments

Claims 1 to 17, withdrawn by virtue of a restriction election, are now cancelled herein.

Claims 18 to 34 are pending in the application. The application contains 2 independent claims and 18 total claims and is therefore in compliance with new Claim Rule 5/25 should that rule take effect in the future.

Claims 25 and 26 are amended to incorporate a conversion of greater than about 80 and less than about 99 weight percent of unsaturated fatty acid or fatty acid ester, based upon the conversion of one unsaturated bond per molecule of unsaturated fatty acid or fatty acid ester. Support for this amendment is found at page 15, lines 13-20, of the specification.

Applicants estimate that no fee is due for the amendments. If this estimate is incorrect, the Office is authorized to charge Deposit Account 04-1512 the required fee.

2. Concerning the Inventorship

The undersigned has reviewed the inventorship of pending Claims 18 to 34. A determination has been made that there is no need to amend inventorship.

3. Concerning the ABSTRACT

The Examiner requests a copy of the ABSTRACT on a separate sheet of paper. Applicants comply with the request by enclosing herewith a copy of the ABSTRACT on a separate sheet of paper numbered as page 27.

4. Concerning the Rejection of Claims 18-24 Under 35 U.S.C. 103(a)

Claims 18 to 24 stand rejected for allegedly being unpatentable over Early et al. (US 3,674,718) in view of Voss et al. et al. (US 4,189,515). The Office Action asserts that "Early et al. substantially discloses the claimed invention, which is a polyol blend comprising a polyether triol and a diol with the weight ratio of polyether triol to diol being 1:8 to 6:8...". Voss et al. is cited for disclosing that small amounts of dihydric to tetrahydric alcohols may be added to monoalcohols for use in preparing polyurethanes. This rejection is traversed for the following reasons.

At the start, Applicant claims an alcohol composition comprising a mixture of hydroxymethyl-substituted fatty acids or fatty acid esters. The mixture comprises from greater than about 10 to less than about 95 percent mono-alcohol; from greater than about 1 to less than about 65 percent diol; and from greater than

about 0.1 to less than about 10 percent triol, by weight. As a further requirement, the alcohol composition has a diol to triol weight ratio (diol/triol) greater than 5/1. The composition is useful as a starting material for preparing polyols for use in preparing polyurethanes. Thus, the claimed composition is not the polyol directly employed in preparing polyurethane foams, but rather a precursor to such polyols.

Specifically, Early et al. discloses polyols of the following species, “ethylene glycol, the triols such as glycerol and trimethylolpropane higher functionality alcohols such as pentaerythritol and inositol, the saccharides such as sucrose, glucose, fructose, and alkyl glucoside, ...the hydroxyalkylated polyamines such as hydroxypropylated ethylene diamine and hydroxymethylated toluene diamine.” “Another group of suitable polyfunctional initiators includes the alkylene oxide adducts of polyhydroxy compounds and saccharides, such as oxypropylated glycerol, oxybutylated trimethylolpropane, oxypropylated sucrose, oxypropylated methyl glucoside, and so forth.” (*Early et al.*, Col. 2, lines 52-64) The disclosed compounds include sugars and diols and polyols having typically short carbon chains of 2 to 6 carbon atoms. The “glucosides” are six-membered ring acetals with methoxy functionality. Cyanoethoxylated functionality is taught to be preferred. The alkylene oxide adducts of said poly-hydroxy compounds comprise a plurality of polyether functionalities. Early et al. (column 3, line 72, bridging column 4, line 4) teaches a preferred composition comprising a mixture of polyether triol of molecular weight 1,000 to 8,000 and polyether diol of molecular weight 60 to 3,000.

In contrast to Early et al., the claimed composition comprises a mixture of fatty acids or fatty acid esters, each component of which comprises a straight (typically unbranched) carbon chain, preferably from 12 to 50 carbon atoms, terminating in a carboxylic acid or ester functionality. Early et al. is silent with respect to this length of carbon chain and acid or ester functionality.

The claimed mixture comprises fatty acids or esters required to be substituted with one (mono), two (di), or three (tri) hydroxymethyl substituents appended to the fatty acid/ester chain. In contrast, the compounds of Early et al. have hydroxy functionality directly bonded to a short carbon backbone or ring carbon atom.

The claimed composition comprises a specific mixture of components namely, mono-alcohol (mono-hydroxymethyl) from greater than about 10 to less than about 95 percent, diol (di—hydroxymethyl) from greater than about 1 to less than about 65 percent, and triol (tri-hydroxymethyl) from greater than about 0.1 to less than about 10 percent, by weight. Early et al. is silent with respect to this specific mixture; nor would the skilled artisan have any logical reason to be directed from Early et al. to this specific mixture.

The claimed composition is not required to contain sub-units of sugars, glycosides, polyether, or polyalkoxylated chains, or cyanoethoxylated functionality, as disclosed by Early et al. The individual components in Applicants’ claimed composition do not reach molecular weights of 3,000 or 8,000, since the individual fatty acid/ester components of Applicant’s claimed composition are not in themselves high molecular weight polyols.

The skilled person would have recognized that all of the polyhydroxy compounds disclosed by Early et al. are derived from sugars or from a petroleum feedstock. In contrast, the claimed composition is derived from seed oils, such as soy oil, thereby providing for a renewable and sustainable feedstock alternative to petroleum.

Early et al. recites a preferred mixture having a weight ratio of polyether triol to diol ranging from 1:8 to about 6:8. For comparative purposes, the ratio is inverted to give a polyether diol/triol weight ratio ranging from 8:1 to 1.33:1 (8:6). In contrast, Applicants' claimed composition is required to have a diol/triol weight ratio (not a polyether either!) greater than 5:1. While some overlap exists with the ratio of Early et al. (>5/1 up to 8/1), Applicants' claim scope exceeds the referenced upper limit of 8/1 and excludes the referenced lower regime less than 5/1. It is shown hereinafter that the claimed diol/triol weight ratio plays an important role in production of flexible polyurethane foams.

Early's polyalcohols are used directly in polyurethane formulations to prepare heat sealable polyurethanes for dielectric materials. The disclosed urethane formulations have high hydroxyl number (20-175) providing high cross-linking density, which would not be suitable for preparing flexible foams. In contrast, Applicants' composition is useful as a starting material or precursor in the preparation of polyols, which prepared polyols are directly useful in polyurethane formulations. The polyols derived from the claimed alcohol composition provide a cross-linking density for flexible polyurethane foam applications, e.g., furniture cushions and pillows.

Thus, it not true that Early et al. substantially discloses the invention; but instead, Early et al. stands a far distance from the claimed invention.

Voss et al. pertains to a polyurethane coating to be applied when molding a polystyrene. The polyurethane is taught to be prepared from a linear or branched monoalcohol optionally incorporated with small amounts of dihydric to tetrahydric alcohols. The dihydric to tetrahydric alcohols are conventional diols, triols, and tetraols preparable from petroleum feedstocks and sugars. None of the specific mono-alcohols or dihydric or trihydric alcohols mentioned are hydroxymethyl-substituted fatty acids or fatty acid esters. The molar ratio of dihydric to tetrahydric alcohols to polyisocyanates is taught to be not more than 0.4:1.

In contrast, the claimed composition comprises a particular combination of mono-, di-, and tri-hydroxymethyl-substituted fatty acids or fatty acid esters, normally obtained from seed oils. Moreover, the claimed composition requires a diol to triol weight ratio greater than 5/1. The ratio in Voss et al. has no relationship to the ratio claimed. At best, Voss et al. teaches that a skilled person can mix alcohols of various types; but that is hardly newsworthy and does not render obvious the invention claiming distinctly different materials in specific concentrations and with a specific diol/triol weight ratio, and also derived from seed oils.

Thus, by all accounts the claimed composition is distinctly different from the polyol compositions disclosed by Early et al. and Voss et al.

It is not obvious how a skilled person could, much less would, arrive at the invention starting from Early et al. and Voss et al., taken individually or together. Neither reference teaches, suggests, or hints at fatty acids or fatty acid esters; or hints at hydroformylating unsaturated fatty acid/esters with subsequent hydrogenation to form hydroxymethyl-substituted mixtures of fatty acids/esters; or discloses the claimed ranges of mono, di, and tri-alcohols; or points the skilled person to a diol/triol weight ratio greater than 5/1. Neither reference pertains to the problem of obtaining a precursor alcohol feedstock from seed oils for use in preparing polyols that are directly used in manufacturing flexible polyurethane foams. A great number of mental leaps and connections would have had to be made to arrive at the invention, for which the references give no motivation, or suggestion, or even a whisper of a hint, even when the skilled person uses common reasoning and logic. Thus, the references do not, individually or together, support a *prima facie* case of obviousness against Claims 18 to 24.

In the alternative, Applicants submit herewith a Declaration under 37 C.F.R. 1.132 describing comparative experiments performed under controlled process conditions, which illustrate the effects of the claimed composition having a diol/triol weight ratio of greater than 5/1, as compared with comparative compositions having a diol/triol ratio less than 5/1, in the preparation of flexible polyurethane foams. Examples 1 and 2 of the Declaration illustrate the preparation of a polyol from the claimed monomer alcohol having a diol/triol weight ratio greater than 5/1, as derived from the hydroformylation of soy methyl esters and subsequent hydrogenation. In Examples 3, 4, and 5, the polyols prepared from the claimed composition are used to prepare flexible polyurethane foams. By comparison, Comparative Experiment CE-1 describes the preparation of a polyol prepared from an alcohol composition having a diol/trio weight ratio less than 5/1, prepared itself from the hydroformylation of linseed oil with subsequent hydrogenation. In Comparative Experiments CE-2, CE-3, CE-4, and CE-5, the comparative polyol is used to prepare comparative polyurethane foams.

From Table 3 of the Declaration, it is seen that the polyurethane foams prepared from the comparative alcohol having a diol/triol weight ratio outside the scope of the claims resulted in polyurethane foams with tin splits and unmeasurable properties, otherwise not suitable for flexible foam applications. In contrast, the polyurethane foams prepared from the polyol which itself was prepared from the alcohol compositions falling within the scope of the claims were found to be suitable for flexible foam applications. The results are unexpected and not predictable from the cited references

In view of the arguments set forth above and unexpected results set forth in the Declaration, it is submitted that Claims 18 to 24 meet the requirements for non-obviousness over Early et al. and Voss et al. It is respectfully requested that the rejection be withdrawn.

4. Concerning the Rejection of Claims 26-34 Under 35 U.S.C. 103(a)

Claims 26 to 34 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Frankel (US 3,787,459) in view of Abatjogou et al. (US 4,731,486) in view of Bahrmann et al. (CA 162,083), in view of Hanes (US 4,633,021), and further in view of Early et al. et al. (US 3,674,718). Ullmann's Encyclopedia is also cited. Citing well known case law, the Office Action asserts a *prima facie* case of obviousness in the absence of unexpected results and where the combined elements of the claims allegedly are familiar and yield predictable results from the prior art. This rejection is traversed for the following reasons.

Claims 26 to 34 teach a process of preparing the claimed alcohol composition described in Section 3 hereinabove. The process comprises hydroformylation of unsaturated fatty acids or fatty acid esters to form a reaction product comprising a mixture of product aldehydes, separation of the aldehydes from the hydroformylation reaction product, and hydrogenation of the aldehydes to form the claimed alcohol composition.

The Examiner has done a good job of explaining the teachings of Frankel, drawn to hydroformylation of a mono-unsaturated fatty acid ester, as well as differences between Frankel and the claims, namely: Frankel lacks express teachings (i) of monosulfonated tertiary organophosphine metal salt ligands, (ii) of using greater than about 80 weight percent conversion of unsaturated fatty acid/esters, (iii) of using a reaction temperature between 45°C and 200°C, (iv) of using a reaction pressure greater than 1 psia and less than 10,000 psia, (v) of using extraction of the formyl product, and (vi) of using Raney nickel for hydrogenation. Frankel also does not teach or illustrate a product comprising a mixture of mono, di, and tri-formyl-substituted compounds having a diol/triol weight ratio greater than 5/1.

Applicants accept that Abatjoglou teaches monosulfonated tertiary organophosphine metal salt ligands for hydroformylation; that the claimed reaction temperatures and pressures overlap with those disclosed in Abatjoglou; that Hanes discloses a type of extraction to remove a catalyst from a hydroformylation reaction mixture into a polar phase; that Bahrmann discloses hydrogenation of an aldehyde using Raney nickel to form the corresponding alcohol (hydroxymethyl-substituted product); and that Ullmann's Encyclopedia may teach Group I and II metals for hydrogenation of aldehydes.

Significantly, Bahrmann neither discloses nor illustrates any example of a diformyl/triformyl or diol/triol weight ratio greater than 5/1. All illustrations in Bahrmann calculate to a diformyl/triformyl weight ratio less than 5/1; and no hydrogenation is illustrated at all.

With regard to Early et al. et al., Applicants oppose its introduction into the rejection. As noted in Section 3 hereinabove, Early et al. is a different compositional "beast" with a broad diol/triol weight ratio of 1.33:1 to 8:1 (triol/diol of 1:8 to 6:8) that does not reflect the unexpected advantages of the selected range (>5/1) illustrated by Applicants' comparative experiments. (*See enclosed Declaration under 37 C.F.R. 1.132*) Accordingly, Early et al. should be removed from the rejection.

Significantly, the entire group of citations, taken individually or taken as a whole lack one elegant and material insight, which the skilled person would not have seen using all of his common knowledge and ordinary logic. The insight (or discovery) is this: When the conversion of unsaturated fatty acids/esters in the hydroformylation step is taken to a value greater than 80 but less than 99 weight percent, the resulting aldehyde mixture when employed in downstream processes results in a polyol and thereafter a polyurethane having acceptable properties for flexible foams. Moreover, contrary to the prior art where conversion is typically based upon total number of unsaturated double bonds, the basis of this invention is different. Instead, conversion, as defined by Applicants in the specification and now in the amended claims, is based upon the conversion of only the first (or one) unsaturated bond per unsaturated fatty acid/ester molecule, regardless whether the molecule contains 1, 2, or 3 unsaturated bonds. The discovery of a relationship between conversion of the first C=C double bond at the hydroformylation stage on the effects of 3rd and 4th stage product properties (hydroformylation ---> hydrogenation/claimed alcohol ---> polyol ---> polyurethane) is nowhere taught or suggested in the cited art and may be unprecedented, or at least very rare, in the chemical arts. The claimed discovery cannot be found in common logic or the ordinary knowledge available in the field, notwithstanding the disclosures of Frankel, Abatjoglou, Hanes, Bahrmann, Early et al., and/or Ullmann's Encyclopedia.

The Examiner is again directed to the Declaration provided herewith for evidence that an unpredictable effect is observed when using the claimed invention having a diol/triol weight ratio greater than 5/1, as compared with a comparative embodiment having a diol/triol weight ratio less than 5/1 as might be inferred, for example, from Bahrmann. The claimed composition leads to acceptable flexible foams; whereas the comparative compositions do not.

In view of the above, Claims 26 to 34 are non-obvious and meet the requirements of 35 U.S.C. 103(a). It is respectfully requested that the rejection be withdrawn.

5. Concerning the Rejection of Claims 18 and 25 Under 35 U.S.C. 103(a)

Claims 18 and 25 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Early et al. et al. (US 3,674,718) in view of Voss et al. et al. (US 4,189,515), in view of Frankel (US 3,787,459), in view of Abatjoglou et al. (US 4,731,486), and in view of Bahrmann et al. (CA 2,162,083). The Office Action argues that Early et al. et al. and Voss et al. et al. "disclose the claimed composition," whereas Frankel, Abatjoglou et al., and Bahrmann et al. "substantially disclose the process of making the alcohol composition of the claimed invention." This rejection is traversed for the following reasons.

Claim 18 is drawn to Applicants' alcohol composition described hereinbefore. Claim 25 is drawn to the same alcohol composition in product-by-process format.

For sake of brevity and respecting the Examiner's time, we shall not repeat the arguments again, which are incorporated herein by reference from Sections

3 and 4 above. We conclude that the claims are not *prima facie* obvious over the cited references, taken alone or together, because (a) the composition claimed is far removed from the compositions of Early et al. et al. and Voss et al. and (b) because the method of making the claimed composition involves an unusual discovery related to conversion of the first double bond in the unsaturated fatty acids/esters in the hydroformylation step and its connection to product properties several stages downstream. The Examiner is referred to Applicants' Declaration under 37 C.F.R. 1.132, for the illustration of unexpected and unpredictable advantages of the claimed composition having a diol/triol ratio greater than 5/1, as compared with a comparative material having a diol/triol ratio less than 5/1, as might be inferred from Bahrmann. The claimed alcohol leads to flexible foams of acceptable properties; whereas the comparative materials led to foams with tins splits and non-measurable properties.

In view of the above, Claims 18 and 25 meet the requirements for non-obviousness. It is respectfully requested that the rejection be withdrawn.

6. Conclusions

Applicants have amended the claims and presented arguments that address the rejections set forth in the Office Action of September 26, 2007. A Declaration has been provided describing comparative experiments that conclusively illustrate the advantages of the claimed composition. In view of the above, it is submitted that Applicants' claims meet the standards for patentability. A Notice of Allowance is respectfully requested at the Examiner's earliest convenience.

Respectfully submitted,

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Enc. (Abstract; Declaration Under 37 C.F.R. 1.132)

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